

MEMORANDUM | September 1, 2015

TO Craig O'Connor, NOAA
FROM Eric English
SUBJECT F3 – Weights for the National Valuation Survey

1. THE NATIONAL VALUATION SURVEY

The national valuation survey collected information about recreation trips to coastal locations throughout the contiguous United States, including trips to the Great Lakes. The trips involved a stay of two nights or more, and had shoreline recreation as the main reason for the trip. The sample for the survey was drawn from a list of household addresses compiled by the United States Postal Service. Respondents in 44 states were contacted, including the parts of Georgia and Texas not covered in the Local Valuation Survey. Alaska, Hawaii, Louisiana, Mississippi, Alabama, and Florida were excluded.

The survey was conducted in two successive releases, or waves. (See Technical Memo F1 – National Valuation Survey for details on the national survey.) Each wave consisted of an initial contact by mail and follow-up telephone interviews. The mail survey was only a single page and included a question about the household's participation in coastal recreation over the previous year. All households that returned the mail survey and said they had engaged in coastal recreation during the previous year were included in the telephone portion of the survey. A fraction of households that had not participated in coastal recreation were subsampled and were also included in the telephone survey.

The telephone survey asked detailed questions about the respondent's recreation trips in the previous six to nine months. Specifically, the first-wave interviews were conducted during July, August, and September of 2012 and asked respondents about their recreation from January 2012 up to the time of the survey. The second wave was conducted in January, February, and March of 2013 and asked respondents about their recreation since July 2012.

The national valuation data set consists of data provided by respondents to the telephone survey. This memorandum describes the development of weights for telephone survey respondents. After weighting, telephone survey respondents are representative of the entire population of individuals age 18 or older living in the 44 states.

2. FEATURES OF THE SURVEY INCORPORATED INTO THE WEIGHTS

The following features of the national valuation survey and sample design are important in developing the weights.

- The sample was based on a stratified random selection of home addresses. There were three strata. States with high expected participation in Gulf Coast recreation were oversampled (including Indiana, Kansas, Kentucky, Michigan, Missouri, Ohio, Tennessee, and Georgia). California, with low expected participation, was undersampled. The third stratum was all other states. Relative to the sampling rate in the third stratum, the sampling rate in oversampled states was 1.5 times higher, and the sampling rate in California was half as high.
- Respondents to the mail portion of the survey who had not participated in coastal recreation were subsampled at a rate of 0.11 for inclusion in the telephone survey.
- The purpose of the survey was to compile a data set representing recreation activities by residents of the 44 states over a 12-month period. Because respondents in each of the two waves reported activities for a six-to-nine-month period, the combination of data from the two waves resulted in overlap in the reporting periods for the two waves. Specifically, respondents in wave 1 reported their activities for a period that included January to March 2012, and some respondents to wave 2 reported activities for January, February, or March 2013 (depending on the date when their telephone interview took place). Likewise, respondents from both waves reported their activities for some or all of the July-to-September period.

3. DEVELOPMENT OF THE WEIGHTS

The steps below describe the development of weights for the national valuation survey.

- **Calculate base weights using sample selection probabilities.** The base weight for each record is the inverse of the selection probability for the sampled address. Selection probabilities take one of three values: one value for the oversampled states, another value for the undersampled states, and a third value for the remaining states. The weight is $d_{hk} = 1/\pi_{hk}$, where d is the weight, π is the selection probability, h is the stratum, and k is the sampled address.
- **Apply a nonresponse adjustment for the mail survey.** Mail survey records fall into one of four categories: 1) those who completed the mail survey (C); 2) those who returned the mail survey but indicated they did not want to participate in the survey (R); 3) those who were ineligible for the mail survey, consisting of invalid or non-residential addresses (I); and 4) those who did not return the mail survey and therefore have unknown status (U).

The categories C, R, I, and U were defined separately for each of six weighting classes, which are six groups of states. The oversampled states are one group, and the undersampled states are another group. The other four groups are the remaining states, divided among the four U.S. Census regions.

The nonresponse adjustment consists of two factors, calculated separately for each of the six weighting classes. Let S represent the sum of the base weights for records in a given response category and a given weighting class (e.g. for each weighting cell L , $S_{CL} = \sum_{k \in C \in L} d_k$). Ignoring the subscript L , the first adjustment factor is

$$A = \frac{S_C + S_R + S_I + S_U}{S_C + S_R + S_I}.$$

This factor was multiplied by the base weight for each record in $C + R + I$, while records in U received a weight of zero. This factor distributed the weight of all records in U , with unknown status, to records in the three remaining categories with known status.

Now let S represent the sum of weights in the same categories as before, but the weights now include the effect of the first adjustment factor. The second factor is

$$B = \frac{S_C + S_R}{S_C}.$$

This factor was applied to each record in C , while records in R and I received a weight of zero. This adjustment eliminated refusals and ineligible while weighting up completed surveys to represent $C + R$, the full eligible population.

- **Adjust for the subsampling of recreation nonparticipants.** Respondents to the mail survey whose household had not participated in coastal recreation during the previous year were subsampled for the telephone survey at a rate of 0.11. To account for this, respondents in S_C who were mail nonparticipants and who were selected for the telephone survey were weighted up by $1/0.11$.
- **Post-stratify to household counts.** At this stage weights for recreation participants and selected nonparticipants were rescaled so that the sum of the weights in each of the six geographic weighting classes matched the total number of households in each weighing class as reported in the 2010 Census. The adjustment factor for a record in class L is

$$H_L = \frac{T_L}{\sum_{k \in L} w_k}.$$

T_L is the total number of households in L . The weights w_k incorporate all adjustments described previously. This is the final adjustment at the household level.

- **Adjust for sub-sampling of adults within a household.** At the start of a telephone interview, a respondent was selected at random from among all members of the household who were 18 or older. Each weight was therefore multiplied by an adjustment factor equal to the number of adults in the household. The weights for those who did not respond to the telephone interview were set to zero.

- **Impute for missing values to be used in raking.** In preparation for raking the weights, a hot-decking procedure filled in any missing values for demographic variables used in the raking. The variables were age (18 to 24, 25 to 34, 35 to 44, 45 to 64, and 65 or older), education (high school or less, some college, bachelor's or higher), race (Hispanic of any race, Black non-Hispanic, other non-Hispanic), and sex. The hot-decking procedure involved dividing the sample into groups, or "cells". Within each cell, a missing value for a given record was filled in using a randomly selected "donor" record from within the same cell. The variables age and sex were filled in first, using as cells the six geographic weighting classes described earlier. Race was imputed using 44 cells, one for each state. Education was imputed using 30 cells, formed by crossing the five age levels with the six geographic weighting classes.
- **Rake each survey wave to control totals from the 2010 Census.** Raking was performed for waves 1 and 2, respectively, using four raking dimensions. Each dimension involved dividing the sample into cells that could be matched to control totals from the 2010 Census. The four dimensions were 1) education crossed with race, resulting in nine cells; 2) age by education, with 15 cells; 3) sex by education, with six cells; and 4) geography by race, with 18 cells. "Geography" refers to the six U.S. regions used as weighting classes.

The raking procedure began by calculating control totals for each cell in each dimension. These are just the total number of people in the U.S. population falling within each cell, according to the 2010 Census. The next step was to sum the sample weights in each cell of the first dimension. Each sample weight in each cell was then multiplied by the ratio of the control total from the Census to the sum of the weights in the cell. The procedure was repeated for the remaining three dimensions, each time beginning with the adjusted weights from the previous step. Cycling through the four dimensions one time represents one iteration. Iterations were repeated until changes in the weights at each iteration fell below a selected convergence criterion.

- **Trim and re-rake.** The weights from each wave were grouped into cells, and large weights within each cell were trimmed. For this step there were 12 cells, formed by crossing the six geographic weighting classes with the respondent's participation status during the previous year as determined in the mail survey. The determination of the "large weight" threshold was based on procedures developed in the literature. After trimming, the weights were re-raked to again match the control totals.
- **Rake to control totals for overlapping months.** Respondents in wave 1 reported their activities for January 2012 and respondents in wave 2 reported their activities for January 2013. January is therefore considered an overlapping month. There were six overlapping months that included data from both 2012 and 2013 in the raw survey data: January, February, March, July, August, and September.

Adjusting for overlap in certain months requires data on recreation trips by month for each respondent, as well as month-specific weights for each respondent. For all non-overlapping months, the monthly weights are just those completed in the previous step.

Only a few respondents to wave 1 reported activities for September 2012 and only a few respondents to wave 2 reported activities for March 2013. The weights for these respondents in these months were therefore set to zero, leaving four overlapping months. Respondents from waves 1 and 2 were combined for each of these four months, respectively. The combined sample for each of the four months was then raked to population control totals. These new weights are the final weights that apply to respondents' reported trips for each of the four overlapping months. The weights from the previous wave-level raking are the final weight that apply to respondents' reported trips for all other months.

- **Generate replicate weights for variance estimation.** A set of 120 replicate weights was created for use in variance estimation. All sampled addresses from each wave were sorted by stratum (oversampled states, undersampled states, and the remaining states), by state within stratum, and by county within each state. For each wave, the first two of the sorted records were considered a pair in group 1, the next two records were a pair in group 2, and so on, for the first 120 pairs. After that the numbering began again, so that the 121st pair was also in group 1. This process continued until all record pairs were placed in one of 120 groups.

One set of replicate weights was created for each of the 120 groups. To generate the first set of replicate weights, one record in each pair of records in group 1 was eliminated. The weight of the other record in each pair was doubled. The weights for all records outside of group 1 were left unchanged. The same process was applied to each of the remaining groups of records to form 120 replicate weights.